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and Maintenance of Way

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Thousand-Mile Trolley Service

IT will soon be possible to travel between New York and Chicago by continuous electric service, a syndicate having been perfected which has taken in the Chicago Electric Traction Company, which by joining with other immense electrified properties will permit of an unbroken ride between the two cities, either by way of Buffalo through the Empire State, or by way of Cleveland through Pennsylvania. This project is made possible by the proposed absorption of the Chicago Company of Indiana, a corporation capitalized for $4,000,000. A gap of thirty-six miles between Kankakee and Harvey requires to be built, which will make, when junction is effected with other lines, a continuous route from the City by the Lake to the eastern metropolis.

The Railway Signal Association

THE results attained by the Railway Signal Association have never assumed the importance nor reached the high plane now occupied at any previous time in its history, mainly for the reason that the efforts of its members have been confined to the prime object of the organization, which is to insure safe operation of traffic. When it is considered that the means to this end have been of as highly a diversified character as those of any other department of railway service, and that the difficulties attending the adoption of standards involve the elimination or improvement of weak or inefficient details, the work stands out prominently for what it is—the best.

The various systems and devices which have done duty in signalling, have been put through the gruelling trial of service and have at last arrived at the stage where the survival of the fittest is the supreme test. The automatic block semaphore has made a record for safety that has earned for it a place in the front rank, where it bids fair to remain for some time, not alone for its own efficiency, but also for the facility with which it lends itself to adaptation of details by which its worth as a safety device may be enhanced. The weeding-out process is yet in its infancy, but the work accomplished to date is of a most satisfactory character, and indicates what unity of purpose will do in one of the most important departments of railway engineering.

The New York Central Terminal

OPERATIONS now under way on the Grand Central Terminal Station, a plan view of the track arrangement of which was presented in the August issue of Railway Engineering and Maintenance of Way, comprise about the first third of the work, which is the eastern side of the terminal and will have the depressed stations, excavations for which are now going on. When this preliminary is completed and tracks laid, this section will be immediately placed in commission and construction on the remaining sections follow. It is estimated that the total cost of the new terminal will be not less than $40,000,000, which figure includes the cost of the terminal station, the reconstruction of quite all of the line to Craton and also to North White Plains, the building of the power houses and sub-stations and also the equipment for the use of electricity. Upon the demolition of the present station, the officers will be removed to the new structure on Vanderbilt avenue, the cost of which is about $250,000.

The new station building will cover eight acres, and the complete terminal sixty-four acres, which will have a capacity for over 1,100 cars, besides increasing the traffic facilities over four times those of the present layout. The new station will have two stories for the entrance of trains, the upper level for through trains, and the other, thirty feet below the street, for suburban traffic, the latter tracks, four in number, being depressed at Fifty-seventh street, and terminating in a loop. The lowest portion of the terminal will be sixty feet below street grade, where there will be tunnels driven for handling of the baggage and express business. Some of the most important moves in connection with this terminal work are the elimination of fifty-five grade crossings, and the building of the four-track tunnel (the only one in the world) at Kingsbridge, which cuts the distance to Buffalo one mile.

Concrete in Railway Construction

AMONG the interesting papers discussed by the Bridge and Building Superintendents at the Pittsburg meeting, there were none that excited a live-

lier interest, or will leave a more lasting impression on the records of the association, than that on "Concrete Building Construction, Including Platforms," which entered into the details of concrete work in railway structures in a manner so thorough as to merit praise for the author (Mr. C. W. Richey, of the Pennsylvania Lines), who had given such careful thought to a subject yet new in the class of engineering work treated; and of special interest in this connection were the particulars referring to a skyscraper of reinforced concrete in Cincinnati, O.

The consideration of the action of frost on the surface of a concrete platform, making it unsafe for pedestrians when finished too smooth, brought out the relief to be obtained by roughtening the surface. Though the need of such treatment has only recently impressed itself, the amount of roughening of the surface and the best means of doing the work, has been a variable quantity thus far. As to protection from the heaving effects of frost, it was developed some years ago that laying the concrete in jointed edges effectually prevented breakage of the sections. It was also brought out that cinders formed an excellent foundation for concrete when laid on made ground in a climate of low temperatures.

Of special interest, in the field yet unexplored, is the behavior of concrete in elevated railway stations and platforms. The time elapsed since these have been installed on the Long Island road has been too short to presage its tenure of life under conditions so widely different from those of a like building on a stable foundation. The vibratory action of an elevated structure and its effect on a concrete building thereon, are the factors on which definite information is awaited, since elements are introduced which have not had the moral backing of a precedent. The fact that these samples of advanced engineering have stood up to their work without signs of disintegration for several months leads to the belief that they will fulfill all expectations.

Roundhouse and shop construction of reinforced concrete is now entirely out of the experimental stage, but there is still much discussion as to the probable damage to walls and roof in the event of careless handling of an engine. The results of perforating a brick wall are too well known to count on, but the damage to a concrete building from an engine going through the wall is yet indeterminate. There are many schemes advanced with the view of preventing disastrous results to such walls, one of which is to install bumping posts inside the walls. There is, however, no actual need of an agent of greater dimensions than a track block of proper design, at the end of each rail; in fact, a turned-up end of the rails is found efficacious in preventing hostlers working damage to the walls of many roundhouses.

The action of fire and water on concrete was well exemplified in the case of the burning of a station at Long Island City about two years ago. Fire alone had no injurious effect on the floor and platforms. It was only when fire and water were combined that the concrete suffered. This experience was practically identical with that found in ash pits of coaling stations, where the water thrown on the hot ashes had set up disintegration, showing that concrete is not the proper material for ash pits, without protection from the effects of fire and water. In many ways the results of the convention noted will be far-reaching, but in none more so than in the dissemination of correct knowledge on concrete construction in railway work.

Obsolete Railway Tracks

RAILROAD tracks have not in the United States shared in the improvement that has been made in other features of railroad engineering. Track has not kept pace with locomotives, cars or bridges, and railroad accidents result largely from primitive methods still employed in respect to track-making and repairing. The steam locomotive has been brought to a high degree of efficiency, the electric locomotive is accomplishing remarkable results and is used to an extent which surprises those not previously acquainted with the numbers already manufactured for special purposes; bridges can be built to carry any loads, but the track does not seem to be materially better than it was twenty-five years ago, except for heavier rails. It is surprising that more accidents do not occur on some roads where tie renewals are considered an expensive luxury and track work is attended to by a low grade of laborers without responsible supervision. The number of heavy passenger trains sent at high speeds over poor track in this country is probably very great, and the comments on this feature of our railway practice by the foreign engineers who visited this country last spring were not at all flattering.

The reason seems to be that railroad track building has been left largely to ordinary hands, while locomotives, cars and bridges have been constructed by educated engineers.—Engineering Record.

[The broad statements of incompetent direction in track building and maintenance which appeared in the above journal, which carrying the title that it does, is supposedly up in railway engineering, are so rankly suggestive of a want of correct information, that it seems almost a waste of time to refute the obvious errors quoted. It is most patent to any one at all conversant with track construction and maintenance that the most rigid supervision is kept on the condition of the roadbed, ties and rails, and it is a fact that the best lines of this country will compare favorably with the best in the world. That this is so is due to the care of officers who have had technical as well as practical training in their duties. The rank and file of track gangs are composed of a medium degree of intelligence in general, but the supervising heads of these gangs are of the stuff that lands their owners in the highest offices of our railway systems. Our contemporary should listen to the deliberations of the American Railway Engineering and Maintenance of Way Association, and note the technical character of its work, if it really believes that the educated engineer has no part in the building of railway tracks of this country.—Editor.]

Bridge and Building Superintendents' Convention

THE Association of Railway Superintendents of Bridges and Buildings held its fifteenth annual convention in Pittsburg, Pa., Sept. 17-19, with headquarters at the Monongahela Hotel, with President C. A. Lichty in the chair. After prayer and an address by Attorney Rodgers, which was responded to by Mr. J.H. Cummin, Secretary S. F. Patterson read his report, which gave the present membership at 290. There was an addition of twenty-four new members, and no deaths during the past year. The total cash receipts during the year were $2,103.29, while the disbursements were $1,946.98, with a balance in the treasury of $156.31. At the afternoon session a report on the construction and maintenance of docks and wharves was read by Mr. H. Rettinghouse, of the Wisconsin Central. In this complete report was given the cost of ore docks at Duluth; Two Harbors and Ashland. Dock No. 3, of the Duluth, Missabe & Northern at Duluth, which had a storage capacity of 80,640 tons, cost $305.39 per lineal foot, or $7.90 per ton of storage capacity. Dock No. 5, of the Duluth Iron Range, at Two Harbors, cost $284 per lineal foot, or $8.12 per ton of storage capacity, and the dock of the Wisconsin Central at Ashland cost $262 per lineal foot, or $6.30 per ton of storage capacity. The details of this report are very minutely carried out.

The report on Concrete Building Construction, Including Platforms, which was read by Mr. C. W. Richey, of the Pennsylvania Lines, was also a document that appealed to the members as a very complete production, going outside of the realm of railway practice to touch on municipal concrete construction. There was considerable discussion of that paper, particularly that portion of it referring to platforms. Mr. W. H. Steffens, of the New York Central, was of the opinion that concrete platforms were too smooth for frosty weather. Mr. Richey explained that the excessively smooth surfaces were the result of too much troweling, and gave as a remedial proposition that the surface should be roughened while the concrete was in a plastic state. Mr. Perry stated that he had put in concrete platforms eight years ago, in alternate sections or squares, which formed joints which would yield and avoid rupture at the sections in case of disturbance by frost. Mr. Cummin had built concrete stations and platforms on elevated railways during the year, and expected to have enough definite data on the ability of such construction to resist the vibrations due to elevated service to report at the next convention. There were no signs of failure at this time. Mr. Killam, of the Intercolonial, gave details of a concrete platform at Levis, Quebec, which was 700 feet long and 35 feet wide, laid on made ground, covered with cinders on which the concrete was laid.

Reinforced concrete was taken up in all its aspects in round house construction, and also the effect of impact from engines on the walls. A hole is generally the result when a locomotive strikes a brick wall, and such damage is easily repaired. The situation with concrete is quite different with reference to the amount of damage done, and the difficulty of making repairs. Mr. Penwell, of the Lake Erie & Western, offered the proposal that concrete round house walls be strengthened by pilasters placed in the danger section. Mr. Hudson, of the St. Louis, Kansas City & Colorado, advocated the use of bumping posts inside of the walls, to which Mr. Penwell met this proposition with the statement that the use of bumping posts would mean a longer stall and therefore increase the cost of construction. Mr. Pickering, of the Boston & Maine, after detailing the damage done by careless hostlers, was of the belief that introduction of bumping posts would not give the relief sought by their sponsors, but he did think that a scheme that was worked out for his round houses would be advantageous. In case of a perforated wall, the hole is bricked up but not filled, but instead of solid brick work, a plank frame about three feet square is put in at the point of impact, having a door on the outside. In case an engine is not stopped short of the wall, the only result is to crash through the door, leaving the wall intact. The speaker would not build a solid concrete wall in line with a round house stall.

Concrete construction seemed to be a subject on which the members warmed, and on which none were unprepared to talk. Mr. Tanner, of the Missouri Pacific, told of concrete cylindrical grain bins and of a concrete smoke stack in Kansas City. Mr. Cummin, of the Long Island, referred to the fireproof advantages of concrete, citing the case of a station which burned at Long Island City some time since, where the concrete floor and platform were unscathed by fire alone and had only suffered through the combined effects of fire and water. It developed that on another road, concrete was not the best material for ash pits, these, too, having shown the effects of water in contact with hot ashes, which formed a combination that could not be resisted. Mr. Richey was of the opinion that concrete should be faced with vitrified brick as an armor to resist heat, but Mr. Clark of the Baltimore & Ohio, had known concrete which had been covered with vitirified brick to fail from disintegration.

Mr. Tanner, when discussing the report on "Methods of Repairing Roofs," called attention to the fact that the copper flashing on a roundhouse roof at Omaha, had been entirely destroyed in a few years. Common roofing felt, coated with pitch, had given satisfactory service. Mr. Cummin's experience had been that no metal flashing would give proper service on roundhouses, since copper and lead corrode; the only flashing that would give good lasting service in his opinion, was felt. Mr. Richey said the Pennsylvania road no longer used slate roof, using in its stead, prepared roofing, and his road had also abandoned gutters on roundhouses for want of material that had the desirable durability.

When the report on protection of water tanks from frost was discussed, Mr. Penwell explained his system of protection, saying that he runs a steam pipe from the pump house to a coil in the frost box, and a pipe connection from the first to the outlet pipe. Mr. Rettinghouse explained his method of accomplishing the same results is to have a steam hose connecting with each water tank, and the engines of certain trains are delegated to thaw the outlet pipes. The discharge pipe is made to leave the tops of the tank, to prevent freezing. Mr. Clark has a frost box made with a wall of matched material, with two ply paper, between the hollow courses. To overcome the effects of extremely low temperature, an ordinary tubular lantern is placed in the frost box. Mr. Killam, of the Intercolonial, had never heard of one of his tanks freezing, he having a frost box made with four partitions with paper lining in each partition. Mr. Large stated that his practice was identical with that of Mr. Killam, and his tank pipes never froze. Mr. Anderson, of the Chicago & Northwestern, kept his tanks from freezing by the introduction of live steam.

There was not much unanimity of opinion on the subject of sheet piling, neither was there any new data brought out. An index of the situation is seen in the experience of some members who had known it to be used with satisfactory results, while others have noted considerable trouble in its use. On pile and framed trestle bridges there was no report at this meeting. In a brief consideration of the matter, Mr. Hudson stated that he had noted greater deflection of trestle stringers under cars of 100,000 lbs. capacity than under engines weighing 220,000 lbs. Mr. Killam struck the key note of correct engineering when he made the statement that observation of the deflection of bridges under passing trains, was of far greater value than any calculation of stresses. The speaker had observed greater deflection of bridges under light engines than was the case with heavier engines at the same speed. In his opinion the motion of the engine sets up stresses that cannot be calculated by engineers.

Discussion of the subject of steel bridges brought out the information that the Pennsylvania road has riveted spans 200 feet long. The Intercolonial has twelve riveted truss spans each of 205 feet length, and fine spans of the same construction of 213 feet length. It developed in this discussion that in a 175-foot riveted span, it requires about 8,000 field driven rivets, and of long rivets, ten-inch had been driven, but such rivets were not in critical locations, and it was believed could be best be driven by hand.

The above considers only the more important topics discussed, but all were of the liveliest possible interest. Mr. Jas. McIntyre retired from the service of the Erie road after a service of thirty-six years, was elected a life member, as was also Mr. E. F. Wise after a like term of service on the Illinois Central.

After the conclusion of the routine business of the meeting, the election of officers was held with results as below: President, J. B. Sheldon, N. Y., N. H. & H. R. R.; First Vice-President, J. H. Markley, T. P. & W. Ry.; Second Vice-President, R. C. Sattley, C. & N. W. Ry.; Fourth Vice-President, J. P. Canty, Boston & Maine R. R.; Secretary, S. F. Patterson, Boston & Maine R. R., re-elected; Treasurer, C. P. Austin, Boston & Maine R. R.; Executive Committee, H. Rettinghouse, Wis. Cent. Ry.; A. E. Killam, Intercolonial Ry.; J. S. Lemmond, Southern Ry.; C. W. Richey, Pennsylvania Lines; H. H. Eggleston, Chicago & Alton Ry.; F. E. Schall, Lehigh Valley R. R.

The exhibit of railway supplies contained the following well known houses:

Joseph Dixon Crucible Co., Jersey City, N. J., Graphite paint.

U. S. Graphite Co., Saginaw, Mich.

F. W. Bird & Sons, East Walpole, Mass., Paroid roofing.

Arthur E. Rindle, New York, Paradigm skylight.

J. D. McIlwaine & Sons, Pittsburg, Norton jacks and railroad supplies.

Barrett Mfg. Co., Philadelphia and New York, roofing and paint.

Fairbanks, Morse & Co., Chicago, railroad supplies.

Menser Bros. & Co., Brooklyn, N. Y., ventilators and roofing specialties.

Paul Dickinson, Chicago, Vitribestos smoke jacks.

U. S. Wind Engine & Pump Co., Batavia, Ill., tanks and water columns.

Philip Carey Mfg. Co., Lockland, O., Magnesia flexible cement roofing.

The National Roofing Co., Tonawanda, N. Y., roofing.

Eastern Granite Roofing Co., New York, roofing.

Standard Paint Co., New York, Ruberoid roofing.

H. W. Johns-Manville Co., New York, asbestos and magnesia products.

*Report on Steel Bridges**

IN preparing its first report your standing committee No. 2 on steel bridges has thought best to study the subject from the standpoint of the supervisor of bridges, rather than that of the engineer; and, as a basis for a report, has canvassed the association on the following subjects:

No. 1. Methods used in erection of the different classes of steel structures, on lines having densities of traffic, giving in each case the cost of work per ton of steel.

No. 2. Methods of riveting.

No. 3. Methods and appliances used in cleaning and preserving steel from corrosion.

No. 4. The experience of the association in the mat-

*Read before the fifteenth annual convention of the Association of Railway Superintendents of Bridges and Buildings.

ter of corrosion of floors, due to dripping from refrigerator cars.

No. 5. Which method of erection do you prefer? By railroad forces, contractor or the builder?

No. 6. What spacing C. to C. for stringers do you prefer on straight track, and do you prefer more than one stringer for each rail?

No. 7. In skew bridges do you deem it advisable to carry the ends of stringers out to finish square with the track?

No. 8. Do you have trouble from breakage of bridge seat stone?

No. 9. What is your opinion of lattice-riveted trusses compared with pin-connected trusses?

No. 10. Would you put elevation in stringers or ties?

From 150 circulars sent out, replies, more or less complete, have been received from 15 members. We are not justified in drawing general conclusions from so few replies, but perhaps the suggestions brought out will lead to fuller discussion in the future.

No. 1. Methods of Erecting Bridges.

For handling material derrick cars are very generally preferred, being used in some cases with extension booms to erect the top chords of the highest trusses. Wrecking cranes are mentioned by several, but these can be used only for setting girders; while properly-equipped derrick cars are applicable to a variety of structures.

Travelers are used for erecting truss spans by some, but derrick cars are replacing travelers wherever available; one writer claiming that trusses are erected as cheaply as girders where the use of travelers can be avoided.

A majority erect girder bridges and sometimes truss spans at one side and slide them into place between trains. Generally trusses and sometimes girders are erected in place and the floor shifted in between trains. The method adopted depends very largely on traffic conditions. One member builds a temporary track around the site where traffic is very heavy. Gallows frames are mentioned for handling very heavy girders, but not to the extent that they deserve; and for deck-plate girders of moderate spans, riveted up complete, a pile driver is suggested as a convenient tool for handling one end.

The cost is given by only a few correspondents, $4 to $20 per ton being the range; girders are quoted at $4 to $10, and truss work $10 to $20. Transportation of material, tools and men is not included in these prices.

The committee would refer those interested in erection problems to the report and discussion on best form of traveler, p. 70 and following, proceedings of 1904, and to report on falsework, p. 102, proceedings of 1903. Local conditions and the exigencies of traffic but if the meagre replies received indicate any particular trend it is to the increasing use of derrick cars built expressly for road department work.

No. 2. Method of Riveting.

There is practical unanimity in recommending pneumatic riveters where the work is of sufficient magnitude to warrant it. Only one reply expressed a preference for hand-driven rivets. Small jobs and sometimes large ones, due to lack of a sufficient number of air plants, are driven by hand, so that work ought to be designed in all cases on the basis of hand driving for field work.

In certain tests made by the committee on iron and steel structures of the American Railway Engineering and Maintenance of Way Association, it appeared that pneumatic hammers upset the rivets in the holes fully as well as the best hydraulic-pressure riveters used by modern bridge shops.

No. 3. Cleaning; and Protecting Steel from Corrosion.

Nearly all the replies report hand cleaning. Four or five have used the sand blast with good results, but it is quite expensive. One has used a strong solution of lye with marked success for cleaning steel for painting. Several parties not using the sand blast express a favorable opinion of it. Those having considerable experience with it, think it practically indispensable where the steel is badly scaled and pitted. When this condition obtains it is not possible to clean iron by hand so but what a coat of paint will be quickly thrown off.

Where ordinary weather rust occurs it can be kept under control by ordinary cleaning and painting, if in about a year after the work is done it is gone over and the spots which show rust a second time are touched up. Certain exposed parts of a structure become rusted before others, of course; and if these parts were repainted two or three times to the other parts once, economy would result. Painters, however, dislike to paint by patchwork, and the result is that the exposed parts are allowed to get beyond control before it is decided to paint the structure as a whole.

As to kinds of paint used, no two replies agree. Several are experimenting with hopes of learning something valuable. It is pretty well ascertained that no one kind of paint is the best for all conditions. Asphaltum paints are much better in sheltered places than in the sun. Linseed oil paints are much better vehicles are better where exposed to engine gases than metallic pigments. An absorbent of moisture is a desideratum for a priming coat. It will be admitted that it is asking much of a film of paint only one one-hundredth of an inch thick, to protect a material so readily oxidizable as our open-hearth oxygen-filled steel, from the corrosive action of engine gases, brine and the weather for a term of years.

It is manifest that the final word has not been written yet on the paint question. The American Society for Testing Materials is doing valuable work investigating the matter. For train-shed roofs the P. R. R. at Jersey City has found it advisable to cover each member of iron work with a thin parafine paper

smoothed on to a coat of undried paint, and then to paint two coats over that. It seems to protect the iron perfectly.

No. 4. Corrosion of Floors from Refrigerator-Car Brine.

Over half the replies report no trouble, or but very little on this score, on account of absence of refrigerator cars from their traffic. Several report a good deal of trouble but use no remedy except frequent cleaning and painting. Mr. Loweth of the Chicago, Milwaukee & St. Paul, writes:

I have lately been covering the tops of stringers and beams with a cotton ducking saturated in a preparation of linoxyn and a resinous flux. This prepared canvas is ironed hot on to the steel surface and adheres more or less perfectly, and I hope to get good results from it; but have not had it in service long enough to say positively. This preparation is called "iron bark," and is manufactured by the Edward Smith Co., New York.

Mr. Cartlidge, C., B. & Q. R. R., writes:

We find that a concrete deck with ballast is an absolute preventive of trouble, and are employing that wherever possible. On bridges where a concrete deck cannot be used, we are having good success with felt roofing; cutting it into strips slightly wider than the flanges of the stringers and placing it there and underneath the ties, first painting the iron with the compound used with the roofing.

No. 5. Erection by Railroad Forces, Contractors or Builders.

A majority of the replies favor erection by railroad forces. Those representing the larger systems generally erect all bridges with their own men. Very few prefer contractors for all bridges. About one half of the replies favor contractors for large jobs and road forces for girders and small structures.

If a railroad system is large enough to keep a force of men and equipment constantly employed the work can certainly be done more economically by them than by contractors, but if idle times occur, the case will be reversed. Railroads of moderate size must maintain repair gangs for making running repairs on iron bridges and these men, supplemented with carpenter crews, can put in small structures. The independent firms who make a specialty of erecting bridges furnish a means for those roads to contract the erection of large bridges independently of the builders, when the latter wish to eliminate erection from their contracts.

There is no difficulty, as some maintain, in having outside parties erect bridges and care for falsework under traffic. The question then resolves itself into one of economy; and it is evident that where such work can be made continuous, railroad men can do it cheapest, but when but little is done the larger jobs should be contracted.

No. 6. Spacing of Stringers.

The replies to this inquiry vary from 5 to 8 feet, several stating the practice on their road and giving a preference for a narrower spacing. No one desires a wider spacing than their standard. One, whose stringers are spaced 7 feet, 6 inches to 8 feet, 6 inches, prefers 7 feet. Another, with 5 feet to 7 feet spacing, prefers 5 feet. Those using our stringers per rail say nothing against the practice; while several using single stringers per rail, object to the possible unequal distribution of the load where more stringers are used.

Where more than two stringers per track are used, the practice varies; one using four stringers spaced 2 feet, 6 inches on centres, all through, making 7 feet, 6 inch centres of outer lines; another has the inner ones 2 feet, 10 inches, and the outer 6 feet, 10 inches on centres; and another, the inner ones 5 feet, and the outer 10 feet. In the latter case the inner stringers are designed for the full load and the outer ones on a lower assumed basis for safety in case of derailment. The two former cases have stringers of equal section on the assumption that the load is equally distributed between them.

This subject should evidently be studied further by the committee. The practice is so divergent that some one must certainly be wrong. The length of standard tie is one element of the problem. The amount that we feel justified in depending on the wooden tie to act as a beam to help out the iron floor beam is another element; and the amount of overhang outside the stringer, that we can admit is a third.

Mr. Carpenter, Southern Railway, says:

Our steel viaducts are . . . spaced 7 feet and 10 feet and in one case as much as 11 feet centres. I think 10 feet and 11 feet centres too much, as we do not get the life of the timber in the cross-ties that we do at 7 feet centres.

This phase of our subject deserves much fuller discussion than it has received, and it is suggested that cross-sections of the arrangement of stringers, ties, guard rails and guard timbers that each member prefers, be collected by next year's committee on this subject. The preference of the members, based on their experience, should be submitted rather than the actual practice on one's road. Attention is called to the report on this subject, finely illustrated, on pages 234 to 239, proceedings of 1897.

No. 7. Finishing Ends of Stringers Square to Track.

The replies are unanimous in favor of squaring the ends of stringers. This is remarkable, as it is certain that many roads do not follow this excellent practice.

It is pertinent for the committee to extend this inquiry to deckplate girders, which can be squared as readily as stringers, although it is frequently not done.

Attention is called to the bridge ends illustrated on pages 240 and 241, proceedings of 1897.

No. 8. Breaking of Bridge Seat Stone.

Six of the fifteen replies report no trouble. The rest report some trouble from breakage of limestone under bearings; especially when they were imperfectly

bedded when they were set. Sandstone, granite and concrete give no trouble. One member complains of breakage of stone under stringers, due to the tearing out of anchor bolts by the movement of the bridge from temperature changes. The design must be defective in such cases, for the stringers should be free to move on wall plates.

As to wall plates and concrete for bearings, attention is directed to page 103, proceedings of 1904.

No. 9. Pin, Versus Riveted Trusses.

The question is worded "lattice riveted trusses" in the circular, but riveted trusses of all types are intended to be included. Of thirteen replies to this inquiry four prefer riveted trusses to pin; three prefer pin to riveted; and four prefer riveted to pin up to certain limiting spans, running from 130 to 160 feet.

Two express no preference, but state that a few riveted trusses have recently been put in on their lines and are giving good satisfaction. Some trouble from the wearing of eyebars on pins is reported, and one advocate of pin connections would make the threaded portion of the pins long enough so that a hole for a cotter pin can be bored outside the nuts. One member on a large and up-to-date road states that his practice is growing towards the larger use of riveted connected trusses, and the observations of your committee accord with this view.

This question, outside of the maintenance features of the two types of trusses, is hardly within the perview of this association. It was threshed over pretty thoroughly by engineers thirty years ago; with the result of concluding that either type, within proper limits of span, was all right if properly designed and built. Pin trusses are cheaply and quickly erected; this consideration led to their almost exclusive adoption in some sections of this country; and, without question, they have been built in the past for spans where riveted work would have been much the best. The tendency, noted above, to build riveted trusses for longer and longer spans shows the recovery from the pin-truss fad.

No. 10. Super-elevation on Curves.

The replies to this question vary widely. Of fifteen replies five are in favor of putting the elevation in the ties, eight prefer putting it in the stringers, and two use raising strips on the stringer or girder under the ties. One tilts spans under 50 feet, and the method of working the elevation into the ties varies.

Like No. 6, this question should be further studied by the committee; and the different practice of various members brought out by illustrations. The point is made that tapered ties are not of equal strength throughout. This argument loses its force if the main stringers are five feet on centres. The arrangement of the iron floor affects this question, and it will be well to study both questions as a unit. No. 7 is closely allied, and the method of passing from the bridge ties to the ground ties may well be included. This covers the form, size, etc., of the parapet or ballast wall.

Our replies are too few to draw very general conclusions from, and a first report cannot be in any way complete, but it is hoped that the foregoing may lead to profitable discussion and show the way to more efficient work in the future.

Respectfully submitted,

H. H. EGGLESTON, Chairman,
J. P. SNOW,
C. H. CARTLIDGE,
H. M. TRIPPE,
J. W. LANTRY.

Meeting of the Railway Signal Association

THE ninth annual convention of the Railway Signal Association was held at Niagara Falls, N. Y., Oct. 10-13, opening to one of the largest and most enthusiastic gatherings of the members in its history. After the address of President Mock, the names of sixty people were proposed for membership, being read by Secretary Balliet, and were elected collectively by him on order. Important action was taken with reference to placing on record the past work of the association in a condensed form, and this compilation, which will be of inestimable value to others aside from the members, will be put in shape by Mr. L. C. Fritch, secretary of the American Railway Engineering and Maintenance of Way Association.

The report of the committee on Signal Lamps, Designs, Oil Used, Care Of, etc., was of such interest and value as to deserve and receive the thanks of the association. The report, which filled a sixteen-page pamphlet, thoroughly covered the design and construction of lamps, and went exhaustively into the power and efficiency of one day burners as compared with those of longer duration, besides which oils for illumination and also maintenance of lamps were handled from the standpoint of the experienced expert. Illustrations of the Adams & Westlake, Dressel and Armspear lamps, with which the tests were conducted, constituted an interesting pictorial addition to the report.

In the report of the committee on Rubber Covered Wire, the listener was reminded of the early troubles of the M. C. B. Association with air brake hose, the report going over similar ground in the matter of quality of rubber, and outlined a system of simple tests which would easily demonstrate the quality of material. This committee also presented a specification and table for insulation, with voltage tests for wires, all of which received the compliment of adoption by the association, after a discussion of some considerable earnestness.

Among the special papers presented, that by Mr. J. A. Peabody on the "Cost of Stopping Trains" was of the highest interest, since it went into a thorough study of a subject that had been but superficially scratched over before. Dr. W. Churchill's paper on the "Roundel Problem" was a most able presentation of the subject of glass making as applied to semaphore practice, and the paper by Dr. N. M. Black, on "Roundels" furnished an admirable supplement to the above in giving the results of his experiments and tests.

The election of officers was as follows: President. C. H. Morrison, Erie Railroad; vice-president, J. H. Peabody, Chicago & Northwestern Railroad; secretary and treasurer, H. S. Balliet, New York Central; members of Executive Committee, J. C. Mock, Michigan Central Railroad. With the close of this meeting there are now 535 members, which includes the eighty-two new names enrolled at this session. The next annual convention was voted to be held in Washington on the second Tuesday in October, 1906, and the next session will be in New York City at the Grand Union Hotel.

There was an extensive representation of signal supplies at this meeting, among which were the following:

Adams & Westlake Co., Chicago, non-sweating balanced draught, steel semiphore and switch lamps; long time burning founts with parabolic reflectors; prism glass reflectors.

Battery Supplies Co., Newark, N. J., Gladstone-Lalande batteries.

Chicago Crossing Bells and Battery Supplies.

Continuous Rail Joint Co., of America, insulating joints.

C. H. Whall & Co., Boston, fiber insulation.

Dayton Manufacturing Company, Dayton, O., storage batteries.

Dressel Railway Lamp Works, New York. Non-sweating switch and semaphore lamps, and long burning founts.

Edison Mfg. Co., Orange, N. J., Primary batteries.

Electric Storage Battery Co., Philadelphia. Chloride accumulator.

Edes Mfg. Co., Plymouth, Mass. Battery zincs.

Fairbanks, Morse & Co., Chicago. Gasoline motor, inspection cars and section gang cars; track velocipede; Boud drill.

Federal Railway Signal Co., New York. No exhibit.

General Storage Battery Co., Boonton. N. J., storage batteries.

Gould Storage Battery Co., New York, storage batteries.

Gordon Battery Co., New York, primary batteries.

General Railway Signal Co., Buffalo, no exhibit.

Hayes Track Appliance Co., Geneva, N. Y., Hayes pivot and lifting derail.

Hall Signal Co., New York, no exhibit.

National Carbon Co., Cleveland, O., Columbia primary battery.

National Storage Battery Co., Buffalo, unit accumulators.

Railroad Supply Co., Chicago, crossing bells; channel pins and battery supplies.

Union Switch & Signal Co., Swissvale, Pa., no exhibit.

United States Battery Co., New Rochelle, N. Y., storage batteries.

Westinghouse Machine Co., East Pittsburg, Pa., storage batteries.

*Cost of Stopping Trains, Compared With the Cost of Maintenance, Operation and Inspection of Interlocking Plants**

By J. A. Peabody, Signal Engineer, C. & N. W. Ry.

THERE exists in the minds of most railroad officials the idea that, if the factor of safety is left out, an interlocking plant is a luxury at any place where traffic is not so great that one is required to facilitate the movements so that all may be handled without increasing the track facilities, or where the time to be made by fast trains makes necessary the saving of every minute possible.

It has been my belief, for a long time, that this idea was erroneous, and when a division master mechanic made the statement that the temporary removal of a certain interlocking plant had cost his company $1,200 per month on account of the additional coal consumed alone, and made necessary on account of the additional stop for all trains, the fact was strongly impressed upon me.

Inquiries made of various officials as to the cost of stopping an average train (all kinds and weights included) on straight, level track and accelerating speed up to that at which the train was running over the cost of running the same train without stop, brought forth a wide divergence of opinion and figures ranging all the way from five cents to five dollars.

There was finally obtained a copy of a letter written by an official of one of the western roads, as follows:

"Dear Sir:

"In reply to yours of the 3rd inst. There were no observations made during the test of Train No. 15, in 1900, as to the cost of stopping and starting trains. I have made a few estimates which may prove of interest.

"For trains such as Nos. 55 and 56, regularly eight cars between .... and ...., and seven between .... and ....; and total weight, including engine and tender, half loaded, about 530 tons, the various items of stopping and starting, from and to a speed of 50 miles per hour, are estimated as follows:

Coal to stop train (air pump) 30 lbs.
Coal to accelerate train.....275 lbs.
Total coal ....305 lbs. at $2.15 per ton. $0.33

*Read at the ninth annual meeting of Railway Signal Association, Niagara Falls, N. Y., Oct. 10-12, 1905.

Brake shoe wear, tire wear	0.03
Brake rigging wear, draft rigging wear, miscellaneous	0.06
Total	$0.42

"The cost of brake shoes per stop is estimated from some experiments now being conducted by the laboratory, and in the course of a few months a more exact figure will be obtainable. The cost of tire wear, brake rigging wear, etc., per stop are estimated.

"With reference to the time lost on account of making stops at various points, I have taken some figures from tests recently made on Trains Nos. 55 and 56. The point at which steam was shut off and the speed were noted and also the point at which the speed at shut-off was attained after starting up. The time in which the train would have covered this distance if no stop had been made, subtracted from the time it actually took, gives the time lost on account of stop, exclusive of time standing at the station.

"Time lost in making stops at various stations, exclusive of time standing at station.

Station	Direction	Speed at time steam shut off	Seconds lost on acct. of stop
....	West	52 M.P.H.	166
	East	54 "	197
....	West	59 "	129
	East	48 "	335
....	West	39 "	90
	East	60 "	180
....	West	52 "	155
	East	45 "	121
....	West	52 "	119
	East	42 "	95

"From the above it is seen that the time lost in making a stop (exclusive of time standing) on a straight and level track is about 145 seconds.

"The records of some tests of Train No. 56 made in 1901, before the........interlocking plant was installed, have been gone over and compared with the tests on No. 56 recently made. The tests show the........interlocking plant has saved 85 seconds on the time of No. 56.

"The cost of stopping and starting a 2,000 ton, 80 car freight train from and to a speed of 35 miles per hour would not be far from $1.00, itemized as follows:

Coal to stop train (air pump) 50 lbs.
Coal to accelerate train.....500 lbs.

Total coal	550 lbs. at $2.15 per ton	$0.56
Brake shoe wear		0.15
Other items (as classified above)		0.29
Total		$1.00

"Both in the case of trains Nos. 55 and 56 and the above freight train, the figures of coal used by the air pumps are based on tests; that required to accelerate the train calculated, and the item of brake shoe wear estimated from tests now going on; and on other items are purely estimates.

Yours truly,

................"

Also from another road the following:

"Dear Sir:

"Referring to our conversation and correspondence in regard to the cost of stopping a train.

"I have looked into this and herewith give you an iltemized account of what I have figured on to form the totals for the stopping of passenger and freight trains:

SIX-CAR PASSENGER TRAIN.

Coal for starting train and for air pump	$0.28
Cost of wear and train on brake rigging and shoes	0.07
Total	$0.35

1500-TON FREIGHT TRAIN.

Cost for starting train and air pump use	$0.40
Cost of brake rigging and shoe wear	0.16
Total	$0.56

"These amounts, however, do not take into consideratoin tire wear, possible wheel sliding, wear and tear of draw-bars and other wear and tear on brakes, or liability of injury to freight in cars and possibly the breaking-in-two when stopping or starting. These figures, you understand, are low and the amounts would possibly be increased five to six cents in the case of a passenger train and 12 to 15 cents in the case of a freight train, if it would be possible to take into account all of the things I have mentioned above.

"Hoping this will give you the information you desire, I am,

Yours truly,

................"

NOTE.—In the above the speed of the passenger train was forty-five miles per hour and that of the freight train fifteen miles an hour.

A short time ago an experiment was made on still another road with the following results:

"A 24-car freight train of 900 tons stopped from a speed of 45 miles per hour, and accelerated to a speed of 45 miles per hour after having run over the same distance at the same place. There was a loss of four minutes of time and the additional use of 440 pounds of coal; the total distance covered in making this test was five miles, and care was taken to have the locomotive fire as near as possible the same at the beginning and end of each trip."

As all these figures were made on a separate basis, they cannot be directly compared.

In the second letter there has been made no allowance for loss of time, as well as the other items mentioned, which in some cases would be considerable.

I have therefore considered that the figures were so conservative that they could not be disputed, and will use the average obtained from them (45 cents in round numbers) in the following illustrations, as the cost of stopping any train; in all of these illustrations it is considered, unless otherwise noted, that additional men have to be employed to operate the interlocking plant.

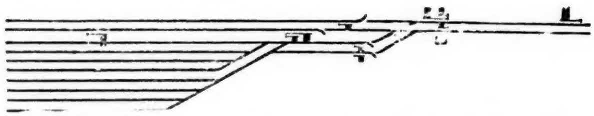
The figures used for the cost of installing are high, and allowance made for electric locking, annunciators, etc., as usually installed in modern plants. The charges

for maintenance and operation are sufficient for first-class work.

The average interlocking plant with proper maintenance will last 20 years, but, to be on the asfe side, I have only allowed for a life of 15 years.

The results are given as though one road only was to pay the total expense; whereas, with crossings the expense is generally divided between the two roads participating.

Each actual case should, of course, be taken up as a separate proposition, and the estimates made with due regards to the local conditions and traffic; far better results can usually be shown than given in these examples, as freight trains are generally more numerous than passenger, and the average saving per train would be increased in proportion.



An Entrance to a Yard from a Double Track.

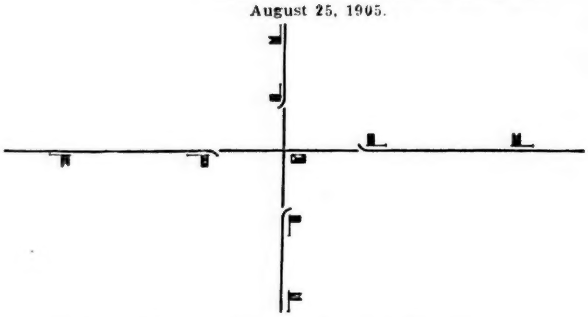
Cost of interlocking plant complete..........$8,000.00
Interest on cost at 4 per cent......$ 320.00
Depreciation per year, 7 per cent.... 560.00
Cost of maintenance per year...... 480.00
Cost of operation per year.......... 1,440.00

Total cost per year............$2,800.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
17	$ 2800 00	$2800 00		$80 0 00		
20	3285 00	2800 00	$ 485 00	8000 00	16.5 yr.	$ 12125 00
25	4105 00	2800 00	1305 00	8000 00	6.13 "	32625 00
30	4930 00	2800 00	2130 00	8000 00	3.8 "	53250 00
40	6570 00	2800 00	3770 00	8000 00	2.12 "	94250 00
50	8210 00	2800 00	5410 00	8000 00	1.48 "	135250 00
60	9855 00	2800 00	7055 00	8000 00	1.13 "	176375 00
70	11495 00	2800 00	8695 00	8000 00	11 mos.	217378 00
80	13140 00	2800 00	10340 00	8000 00	9.3 "	258500 00
90	14780 00	2800 00	11980 00	8000 00	8 "	299500 00
100	16425 00	2800 00	13626 00	8000 00	7 "	340625 00

Signal Engineer Office, C. & N. W. Ry.,
August 25, 1905.



Single Track Crossing Single Track.

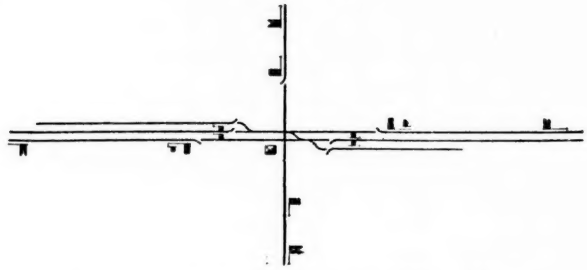
Cost of interlocking plant complete..........$7,000.00
Interest on cost at 4 per cent........$ 280.00
Depreciation per year, 7 per cent.... 490.00
Cost of maintenance............... 420.00
Cost of operation per year.......... 1,440.00

Total cost per year............$2,630.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
16	$ 2630 00	$2630 00		$7000 00		
20	3285 00	2630 00	$ 655 00	7000 00	10.7 yrs.	$16375 00
25	4105 00	2630 00	1475 00	7000 00	4.75 "	36875 00
30	4930 00	2630 00	2300 00	7000 00	3 '	57500 00
40	6570 00	2630 00	3940 00	7000 00	1.8 "	98500 00
50	8210 00	2630 00	5580 00	7000 00	1.25 "	139500 00
60	9855 00	2630 00	7225 00	7000 00	1 "	180625 00
70	11495 00	2630 00	8865 00	7000 00	9.5 mos.	221625 00
80	13140 00	2630 00	10510 00	7000 00	8 "	262750 00
90	14780 00	2630 00	12150 00	7000 00	7 "	313750 00
100	16425 00	2630 00	13795 00	7000 00	6 "	344875 00

Signal Engineer's Office, C. & N. W. Ry.,
August 26, 1905



A Single Track Crossing a Double Track, including Station Switches.

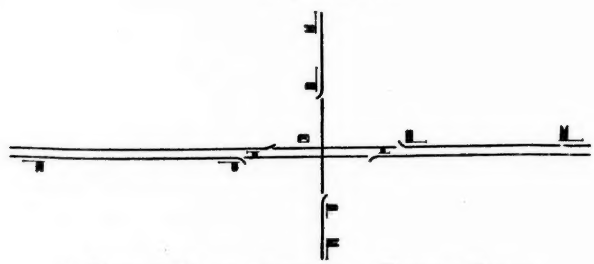
Cost of interlocking plant complete.........$10,500.00
Interest on cost at 4 per cent.......$ 420.00
Depreciation per year, 7 per cent.... 735.00
Cost of maintenance per year....... 480.00
Cost of operation................. 1,440.00

Total cost per year...........$3,075.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
19	$ 3075 00	$3075 00		$10500 00		
25	4105 00	3075 00	$ 1030 00	10500 00	11.9 yrs.	$ 25750 00
30	4930 00	3075 00	1855 00	10500 00	5.6 "	46375 00
40	6570 00	3075 00	3495 00	10500 00	3 "	97375 00
50	8210 00	3075 00	5135 00	10500 00	2 "	128375 00
60	9855 00	3075 00	6780 00	10500 00	1.5 "	169500 00
70	11495 00	3075 00	8420 00	10500 00	1.25 "	210500 00
80	13140 00	3075 00	10065 00	10500 00	1 "	251625 00
90	14780 00	3075 00	11705 00	10500 00	11 mos.	292625 00
100	16425 00	3075 00	13350 00	10500 00	9 "	333750 00

Signal Engineer's Office, C. & N. W. Ry.,
August 25, 1905.



A Single Track Crossing a Double Track.

Cost of interlocking plant complete..........$8,000.00
Interest on cost at 4 per cent.......$ 320.00
Depreciation per year, 7 per cent.... 560.00

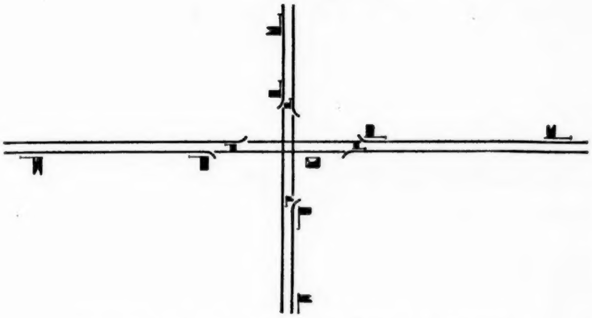
Cost of maintenance per year........ 480.00
Cost of operation.................... 1,440.00

Total cost per year.............$2,800.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
17	$ 2800 00	$2800 00		$8000 00		
20	3285 00	2800 00	$ 485 00	8000 00	16.5 yrs.	$12125 00
25	4105 00	2800 00	1305 00	8000 00	6.13 "	32625 00
30	4930 00	2800 00	2130 00	8000 00	3.8 "	53250 00
40	6570 00	2800 00	3770 00	8000 00	2.12 "	94250 00
50	8210 00	2800 00	5410 00	8000 00	1.48 "	135250 00
60	9855 00	2800 00	7055 00	8000 00	1.13 "	176375 00
70	11495 00	2800 00	8695 00	8000 00	11 mos.	217375 00
80	13140 00	2800 00	10340 00	8000 00	9.3 "	258500 00
90	14780 00	2800 00	11980 00	8000 00	8 "	299500 00
100	16425 00	2800 00	13625 00	8000 00	7 "	340625 00

Signal Engineer's Office, C. & N. W. Ry.,
August 25, 1905.



DOUBLE TRACK CROSSING DOUBLE TRACK.

Cost of interlocking plant complete...........$9,000.00
Interest on cost at 4 per cent........$ 360.00
Depreciation per year, 7 per cent..... 630.00
Cost of maintenance per year........ 480.00
Cost of operation per year........... 1,440.00

Total cost per year.............$2,910.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
18	$2900 00	$2900 00		$9000 00		
20	3285 00	2900 00	$ 385 00	9000 00	23.4 yrs.	$ 9625 00
25	4105 00	2900 00	1205 00	9000 00	7.5 "	30125 00
30	4930 00	2900 00	2030 00	9000 00	4.43 "	50750 00
40	6570 00	2900 00	3670 00	9000 00	2.4 "	91750 00
50	8210 00	2900 00	5310 00	9000 00	1.7 "	132750 00
60	9855 00	2900 00	6955 00	9000 00	1.3 "	173875 00
70	11495 00	2900 00	8595 00	9000 00	1 "	214875 00
80	13140 00	2900 00	10240 00	9000 00	10 mos.	256000 00
90	14780 00	2900 00	11880 00	9000 00	9 "	297000 00
100	16425 00	2900 00	13525 00	9000 00	8 "	338125 00

Signal Engineer's Office, C. & N. W. Ry.,
August 25, 1905.

SINGLE TRACK DRAWBRIDGE, CONSIDERING THAT MEN ALREADY EMPLOYED CAN OPERATE PLANT.

Cost of interlocking plant complete..........$6,000.00
Interest on cost at 4 per cent........$ 240.00
Depreciation per year, 7 per cent.... 420.00
Cost of maintenance per year........ 420.00
Cost of operation per year (supplies only)........................ 120.00

Total cost per year............$1,200.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
7	$ 1200 00	$1200 00		$6000 00		
10	1640 00	1200 00	$ 440 00	6000 00	14 yrs.	$11000 00
15	2465 00	1200 00	1265 00	6000 00	5 "	31625 00
20	3285 00	1200 00	2085 00	6000 00	3 "	52125 00
25	4105 00	1200 00	2905 00	6000 00	2 "	72625 00
30	4930 00	1200 00	3730 00	6000 00	1.6 "	93250 00
40	6570 00	1200 00	5370 00	6000 00	1.12 "	134250 00
50	8210 00	1200 00	7010 00	6000 00	10.3 mos.	175250 00
60	9855 00	1200 00	8655 00	6000 00	8.3 "	216375 00
70	11495 00	1200 00	10295 00	6000 00	7 "	257375 00
80	13140 00	1200 00	11940 00	6000 00	6 "	288500 00
90	14780 00	1200 00	13580 00	6000 00	5.3 "	339500 00
100	16425 00	1200 00	15225 00	6000 00	4.7 "	380625 00

Signal Engineer's Office, C. & N. W. Ry.,
August 26, 1905.

SINGLE TRACK DRAWBRIDGE, CONSIDERING THAT EXTRA MEN WILL BE REQUIRED TO OPERATE PLANT.

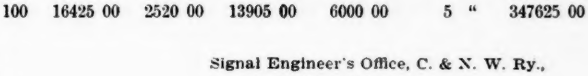
Cost of interlocking plant complete.........$6,000.00
Interest on cost at 4 per cent........$ 240.00
Depreciation per year, 7 per cent.... 420.00
Cost of maintenance per year....... 420.00
Cost of operation per year.......... 1,440.00

Total cost per year............$2,520.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
16	$ 2630 00	$2520 00		$6000 00		
20	3285 00	2520 00	$ 765 00	6000 00	8 yrs.	$19125 00
25	4105 00	2520 00	1585 00	6000 00	3.8 "	39625 00
30	4930 00	2520 00	2410 00	6000 00	2.5 "	60275 00
40	6570 00	2520 00	4050 00	6000 00	1.5 "	101250 00
50	8210 00	2520 00	5690 00	6000 00	1 "	142250 00
60	9855 00	2520 00	7335 00	6000 00	10 mos.	183375 00
70	11495 00	2520 00	8975 00	6000 00	8 "	224375 00
80	13140 00	2520 00	10620 00	6000 00	7 "	265500 00
90	14780 00	2520 00	12260 00	6000 00	6 "	306500 00
100	16425 00	2520 00	13905 00	6000 00	5 "	347625 00

Signal Engineer's Office, C. & N. W. Ry.,
August 26, 1905.



DOUBLE TRACK DRAWBRIDGE, CONSIDERING THAT MEN ALREADY EMPLOYED CAN OPERATE PLANT.

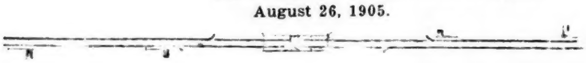
Cost of interlocking plant complete..........$7,000.00
Interest on cost at 4 per cent........$ 280.00
Depreciation per year, 7 per cent.... 490.00
Cost of maintenance per year....... 420.00
Cost of operation per year (supplies only)......................... 120.00

Total cost per year.............$1,310.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
8	$ 1310 00	$1310 00		$7000 00		
10	1640 00	1310 00	$ 330 00	7000 00	21 yrs.	$ 8250 00
15	2465 00	1310 00	1155 00	7000 00	6 "	28875 00
20	3285 00	1310 00	1975 00	7000 00	3.5 "	49375 00
25	4105 00	1310 00	2795 00	7000 00	2.5 "	69875 00
30	4930 00	1310 00	3620 00	7000 00	1.9 "	90500 00
40	6570 00	1310 00	5260 00	7000 00	1.3 "	131500 00
50	8210 00	1310 00	6900 00	7000 00	1 yr.	172500 00
60	9855 00	1310 00	8545 00	7000 00	10 mos.	213625 00
70	11495 00	1310 00	10185 00	7000 00	8 "	254625 00
80	13140 00	1310 00	11830 00	7000 00	7 "	295750 00
90	14780 00	1310 00	13470 00	7000 00	6 "	336750 00
100	16425 00	1310 00	15115 00	7000 00	5.5 "	377875 00

Signal Engineer's Office, C. & N. W. Ry.,
August 26, 1905.



Double Track Drawbridge, Considering that Extra Men will be Required to Operate Plant.

Cost of interlocking plant complete..........	$7,000.00
Interest on cost at 4 per cent........	$ 280.00
Depreciation per year, 7 per cent.....	490.00
Cost of maintenance per year........	420.00
Cost of operation per year...........	1,440.00
Total cost per year.............	$2,630.00

SAVING TO BE EFFECTED.

Trains per day	Cost per year acct. stopping trains	Total cost per year interest, deterioration, maintenance and operation	Net saving per year	Cost of Interlocking Plant complete	Time required to pay for installation from saving	Saving—capitalized at four per cent.
16	$2630 00	$2630 00		$7000 00		
20	3285 00	2630 00	$ 655 00	7000 00	10.7 yrs.	$16375 00
25	4105 00	2630 00	1475 00	7000 00	4.75 "	36875 00
30	4930 00	2630 00	2300 00	7000 00	3 "	57500 00
40	6570 00	2630 00	3940 00	7000 00	1.8 "	98500 00
50	8210 00	2630 00	5580 00	7000 00	1.25 "	139500 00
60	9855 00	2630 00	7225 00	7000 00	1 "	180625 00
70	11495 00	2630 00	8865 00	7000 00	9.5 mos.	221625 00
80	13140 00	2630 00	10510 00	7000 00	8 "	313780 00
90	14780 00	2630 00	12150 00	7000 00	7 "	315750 00
100	15425 00	2630 00	13795 00	7000 00	6 "	344875 00

Signal Engineer Office, C. & N. W. Ry.,
August 25, 1905.

Personals

Mr. W. H. Fenley has been appointed supervisor of signals of the Chicago & Great Western, with offices at St. Paul, Minn.

Mr. T. J. Madigan has been appointed roadmaster of the Toledo, St. Louis & Western at Frankfort, Ind.

Mr. G. H. Kilner has been appointed assistant superintendent of tracks of the New York Central at Canandaigua, N. Y.

Mr. H. E. Allen has resigned as general roadmaster of the Fort Worth & Denver City, at Fort Worth, Tex.

Mr. Clarence M. Du Bois, of New Brunswick, N. J., has been appointed assistant engineer of the Isthmian Canal Commission.

Mr. Wm. C. Curd has been appointed engineer of maintenance of way of the Macon, Dublin & Savannah at Macon, Ga.

Mr. Samuel D. Brady has been appointed chief engineer of the Marietti, Columbus & Cleveland, with offices at Marietta, O.

Mr. W. J. Logan has been appointed roadmaster of the Chicago, Rock Island & Pacific at McFarland, Kan., to succeed Mr. E. Muschott, transferred.

Mr. D. J. Shall has been appointed assistant superintendent of maintenance of way of the San Antonio & Arkansas Pass at Yoakum, Tex., vice J. H. Kelsall, deceased.

Mr. W. P. Allen has been appointed supervisor of signals of the Philadelphia division of the Pennsylvania Railroad at Harrisburg, Pa., vice Mr. J. R. Jones, retired, taking effect on October 1st.

Mr. W. L. Darling, who has tendered his resignation as chief engineer of the Chicago, Rock Island & Pacific, has been chosen chief engineer of the Pacific Railway, projected from Wallula to Seattle, Wash.

Mr. A. E. Winter has been appointed foreman of bridges and buildings of the Chicago & Northeastern at Fond du Lac, Wis., to succeed Mr. C. A. Lichty, transferred.

Mr. George Cowies has been appointed chief engineer of the Guthrie, Fairview & Western, and Mr. Wm. C. McKee has been appointed superintendent of bridges.

Mr. A. H. Jones has been appointed assistant engineer of the Grand Trunk Pacific at Portage la Prairie, Man. He will have charge of construction of the first section west of Winnipeg.

Mr. John Clark has been appointed chief supervisor of track of the New York, Chicago & St. Louis at Cleveland, O., succeeding Mr. C. B. Hoyt, who has been assigned to other duties, taking effect on October 20th.

The title of Mr. J. E. Schwitzer, who was recently transferred from the position of division engineer of the central division of the Canadian Pacific at Winnipeg, Man., is principle assistant engineer, with headquarters at Winnipeg.

Mr. J. Francis Le Baron has resigned as chief engineer of the Louisville, Cumberland & Chattanooga to become consulting engineer of the United States & Nicaragua Company and chief engineer of the Great Central Railway of Nicaragua.

Mr. A. S. Zinn, formerly division engineer of the Chicago, Rock Island & Pacific at Oklahoma City, Okla., has been appointed assistant to the chief engineer of the Chicago & Western Indiana, with offices at Chicago.

Mr. H. J. Pfiefer has been appointed engineer maintenance of way of the St. Louis Merchants Bridge Terminal Railway and Terminal Railway Association of St. Louis, with offices at St. Louis, Mo., vice J. L. Armstrong.

Mr. A. Shane has been appointed superintendent of bridges and buildings of the Toledo, St. Louis & Western and Mr. D. Nowland has been appointed superintendent of roadway and track with headquarters at Frankfort, Ind.

Mr. C. T. Dyke has been appointed resident engineer of the Pierre, Rapid City & Northwestern, at Pierre, S.

D. This road is a branch of the Chicago & Northwestern, which is being built from Pierre to Rapid City, S. D.

Mr. John Tate has been appointed roadmaster of the Illinois division of the Atchison & Santa Fe at Chillicothe, Ill., to succeed Mr. R. I. Gleason. Mr. A. L. Oliphant has been appointed roadmaster of the Southern Kansas division at Moline, Kan.

Mr. Frank H. Alfred has resigned as chief engineer of the Pere Marquette to accept a position of general manager of the Canadian White Company, Limited, with headquarters at Sovereign Bank Building, Montreal, Canada.

Mr. F. E. Baxter has resigned as division engineer of the Denver & Rio Grande at Salt Lake City, Utah, to accept a position with Deal Bros. & Mendendall, railway contractors, of Springville, Utah, in charge of their construction contract on the Western Pacific.

Mr. H. T. Douglas, Jr., has been appointed chief engineer of the Wheeling & Lake Erie, Wabash, Pittsburg Terminal & West Side Belt, with headquarters at Pittsburg, Pa., vice Mr. Geo. T. Barnsley, assigned to other duties, taking effect on Oct. 16. Mr. Douglas formerly was consulting engineer of the roads named.

Mr. W. L. Seddon, formerly assistant engineer of the Sea Board Air Line has been appointed chief engineer with headquarters at Portsmouth, Va., succeeding Mr. W. W. Gwathmey, Jr., resigned. Mr. B. F. Mackall has resigned as assistant engineer at Portsmouth. It is stated that Messrs. Gwathmey and Mackall will engage in a general engineering and contracting business at Norfolk, Va.

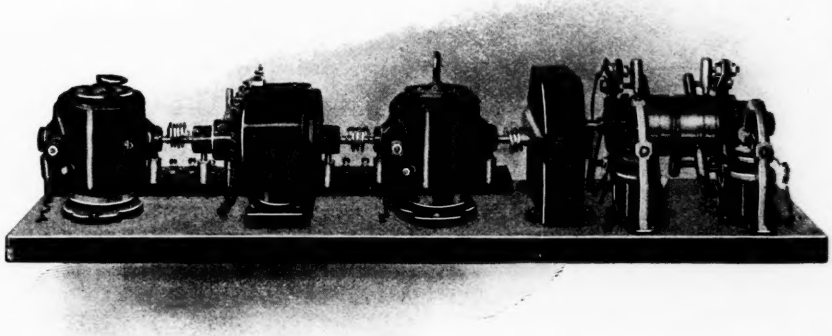
Mr. M. J. Caples, general manager of the Southern & Western, the Lick Creek & Lake Erie and the Carolina Co., has also assumed the duties of chief engineer of those companies, succeeding Mr. Geo. R. Kent, who has been appointed chief engineer of the coal land department. Mr. Wm. A. Hankins has been appointed principle locating engineer of the South & Western; Mr. Walter A. Doane, principle assistant engineer; Mr. C. H. Crosby, division engineer, and Mr. A. W. Jones, division engineer.

Mr. W. L. Darling has resigned as chief engineer of the Chicago, Rock Island to accept an engagement elsewhere, his resignation to take effect as soon as a successor is appointed. Mr. Darling has been chief engineer of the Rock Island since August, 1903, and previous to that time had been connected with the Northern Pacific for a number of years. From January, 1889, to March, 1891, he was assistant engineer; from March, 1891, to July, 1898, principal assistant engineer, and from the latter date to September, 1901, assistant chief engineer. On the last named date he was made chief engineer, remaining in that position until he went to the Chicago, Rock Island & Pacific.

The sudden death of William E. Wood, division freight agent of the Lackawanna Railroad at Syracuse, is keenly felt not only by the officials of his company, but the entire personnel of the road. Mr. Wood was thirty-five years old, and was connected with the company for more than 18 years prior to his death, which occurred at his home in Syracuse. Starting as a local agent, Mr. Wood gained promotion by his loyalty, integrity and ability, while his personal qualities endeared him to the communities in which he lived. When the present management of the Lackawanna Railroad assumed control Mr. Wood was local freight agent at Syracuse, where his admirable work at once attracted notice and his loyalty, faithfulness and ability gained recognition in the promotion to the position of division freight agent, having jurisdiction of Lackawanna territory north of Binghamton. In that position, by his energy and personal charm, he not only gained substantial increase in business for his company, but won the deep and affectionate regard of a wide circle of friends. Both by officials and employes he was held in the highest esteem, and while he had not been in good health for a number of months, his sudden death came as a severe shock to all. He leaves a wife and one child.

Block Signals

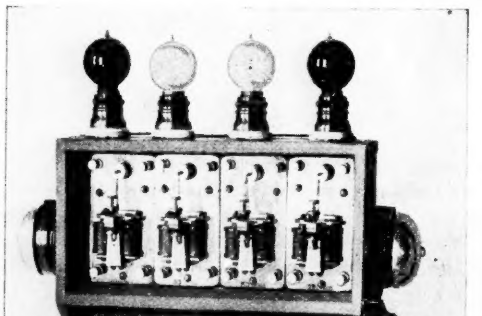
The McClintock automatic block system and locomotive telegraph is a system complete in itself, whereby an engineer can communicate with another of a moving train either moving in same or opposite direction for any desired distance, and also communicate with station from a moving



Pole-Changer and Generators—Front View.

train any place between stations and the station agent may at any time signal the engineer on a moving train by simply using an ordinary telegraph key. The system consists of electrical apparatus placed in the cab of each locomotive and telegraph instruments placed in each station and two small metallic conductors placed parallel to the main rails. These conductors may be of any desired size and in form of a rail, but it is not necessary that they should be larger than the weight of 8 lbs. per yard, (and they may be made a great deal smaller than this and will produce the same effect). The conductors are laid in blocks insulated from each other and the main rails in such a manner that one overlaps the other. The blocks preferably made from three to six miles in length, as the case may require, each block overlapping the block on opposite side of the track, one-half its length, and the track rails being electrically connected at each joint, making two complete electrical circuits and the instruments in the cab are so constructed that when one train enters a block not occupied by another, the signal in the cab displays a white light, (that is, providing there is no broken rails or open switches within the block). This light is operated by a relay and the current actuating it passes over one main rail and one auxiliary rail through a relay in the station or at the end of the block. These relays contract and release every half second so there can be no mistake in their operating perfectly, and when two trains enter a block each engineer will have a warning given him, (by means of an electric light and bell). This warning shows each engineer whether the train is ahead or in the rear of his train, the distance, and in which way the other train is moving, and by means of a telegraph key or telephone, he may communicate with another engineer or a station operator while his train is moving or standing, and the instruments automatically form a short circuit as soon as a train enters a block where there is an open switch. A broken rail, burning bridge or any deranged condition of the track which would derail or wreck a train, is also shown, by breaking the white light circuit and thereby showing a danger signal.

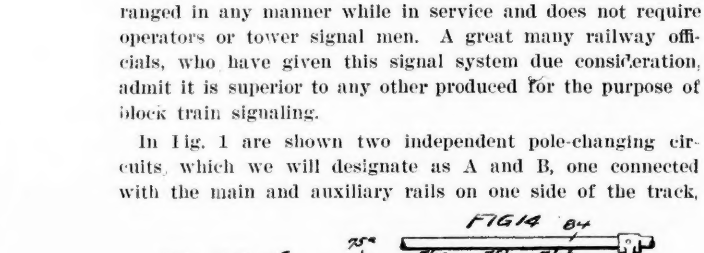
The instruments are very simple and are absolutely reliable in every respect. They consist of a switch-board (Fig. 2, located in the engineer's cab at any desired place), and on this switch-board are mounted four small relays. These relays are of differential windings and are connected to small dynamos and through the relays and over the pole-changer, passing on one side of the track rail and the other to the auxiliary rail, and when a train enters a block occupied by another train, equipped with this system, the current generated by the dynamo in the opposite engine will form a complete electrical circuit between each train and thereby multiplying the current which passes over the relays, which control red lights and electric bells in the cab of both locomotives. These instruments may be operated by the station operator, by simply using his telegraph key which is connected to the main auxiliary rails by wires from station. Thus it is readily seen that this device is absolutely practical.



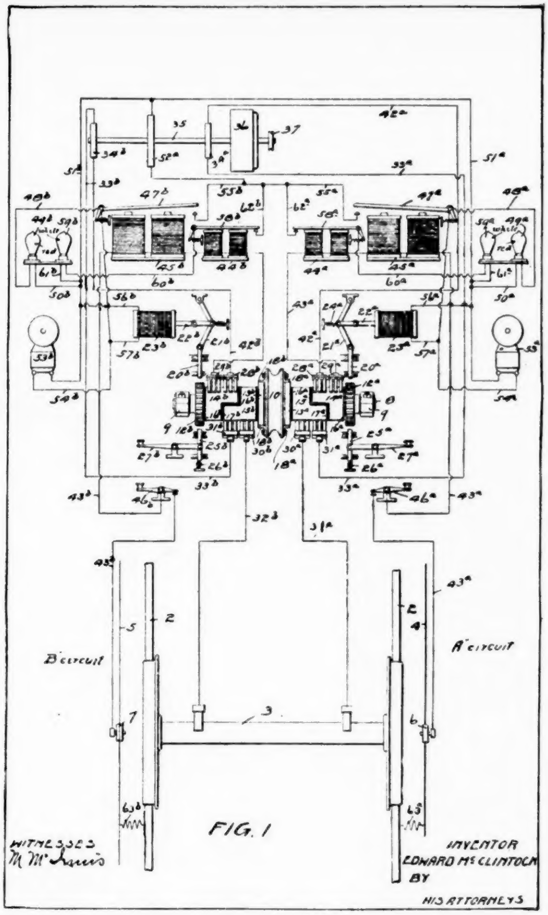
SWITCHBOARD.

As to the construction of the instruments, only such machinery as is in every day use are used, namely: dynamos, steam turbins, electric lights, telegraph relays, knife-blade switches, telegraph keys and pole-changer (all of which are so constructed that they cannot get out of order in any way to impair the workings of the system). With regard to the small auxiliary rail which is used in connection with the main rail: This rail may be laid at a level or a little above the main rails, may either be parallel between or outside of the main tracks and suitable trolleys, or shoes are fastened to the locomotive in such a manner as to form a contact with these rails at all times. This style of third rail system, as it may be called, is in use, in a very similar manner, in several places in the United States, namely: A railway line extending between Chicago and Aurora, having a third rail surface line, and this system operates its train under all weather conditions without any difficulty, snow, ice and sleet having absolutely no effect upon this system. Dynamos are used to supply the current necessary to operate it and these dynamos are carried in the cab of the locomotive, and every person who is familiar with the workings of electrical apparatus will at once recognize the superiority of using dynamos to supply the current over the ordinary system of using batteries (which are at present universally adopted for all outside signaling apparatus). This eliminates all possibility of any part of the apparatus freezing up or becoming deranged in any manner while in service and does not require operators or tower signal men. A great many railway officials, who have given this signal system due consideration, admit it is superior to any other produced for the purpose of block train signaling.

In Fig. 1 are shown two independent pole-changing circuits, which we will designate as A and B, one connected with the main and auxiliary rails on one side of the track,



SWITCH SHOWING AUXILIARY RAILS AND SHORT-CIRCUITING DEVICE.



and the other with the corresponding rails on the other side, and as each circuit is a duplicate of the other it will be sufficient in this case to describe one of them only, the operation of both being substantially the same; 2 represents the track rails and 3 the wheels of a truck thereon; 4 and 5 are auxiliary rails arranged parallel with the main rails and insulated from them and from each other. These auxiliary rails are divided into sections or blocks with alternating joints, the rails on one side being in the A circuit and the corresponding rails on the other side in the B circuit.

Trucks 6 and 7 are arranged on these auxiliary rails, one for each circuit. A pole-changing device is provided in any suitable place on the locomotive and consists of a shaft 8 mounted in bearings 9, and provided at a point intermediate to its ends with a sheave 10. The shaft is provided on each side of the sheave with a pole-changing device, one for each circuit, and which are similar in construction and operation.

11a is an insulating core loosely mounted on the shaft 8 and having heads 12a and 13a secured to said core and separated from commutator plates 14a and 15a by insulating discs 16a. The abutting ends of the plates 14a and 15a are recessed and coincide with each other and are separated by an insulating strip 17a. Springs 18a are secured on the sheave 10 and bear upon the spool head 13a with sufficient pressure to drive the spool when the shaft and sheave are revolved. The head 12a is provided in its periphery with a series of teeth 19a that are adapted to receive a pin 20a which locks the spool against revolution. A toggle link mechanism 21a is connected with the pin 20a, and to the armature 22a of a solenoid 23a. A spring 24a normally holds the armature withdrawn from the solenoid. On the opposite side of the pole-changer is provided a pin 25a normally held in a retracted position by a spring 26a and pivotally connected to a key 27a. By pressing the key the engineer can move the pin 25a into engagement with the teeth of the head 12a and lock it and the pole-changer against revolution.

The plates 14a and 15a are each provided with a pair of brushes 28a and 29a, and 30a and 31a. The brushes 29a and 30a are arranged to bear respectively at all times upon the plates 14a and 15a, while the brushes 28a and 31a alternate in contacting with said plates and thus affect a reversal in the direction of travel in the current to render the system effective regardless of the direction of movement of the locomotives.

A wire 32a connects the brush 30a with the truck 3 and a similar wire 33a leads from the brush 31a to one pole of a generator 34a mounted on a shaft 35 that is driven preferably by steam turbine 36 and is provided with a pulley 37, with which the sheave 10 is connected by a suitable belt.

It is preferable to provide a speed reducing device consisting of pulleys connected by belts with the pulley 37 and the sheave 10 and the other pole of the generator 34a is connected by a wire 42a with the brush 28a. A similar generator is provided on the other end of the shaft 35 which is located in the other circuit and is designated by reference numeral 34b.

The brush 29a is connected by a wire 43a with electromagnets 44a and 45a, and from thence passes to a telegraph key 46 and to the truck 6. The magnet 45a is provided with an armature 47a connected by a wire 48a with a red lamp 49a. A wire 50a leads from the lamps to a wire 51a that is connected to one pole of a generator 52a on the shaft 35. The wire 51a is also connected to one post of a bell 53a, and the other post is connected by a wire 54a with the armature 47a. A wire 55a leads from the other pole of the generator 52a to a contact point in the path of the armature 47a.

When the magnets 45a are energized the armature will be attracted and close the circuit through the red light 49a, and the alarm bell 53a. The solenoid 23a is connected by wires 56a and 57a with the wires 51a and 54a, and consequently when the circuit is closed through the magnets 45a, the solenoid will be energized to attract its armature, project the pin 25a and lock the pole-changer of the circuit A against further revolution. The magnets 44a have an armature 58a connected with a white light by a wire 60a, and a wire 61a leads from the said light to the wire 51a. A wire 62a leads from the wire 55a to a contact in the path of the armature 58a, and a resistance coil 63a is provided between the auxiliary rail 4 and the contiguous main track rail 2. This resistance coil closes the circuit between the rails and establishes a continuous current through the magnets 44a and 45a, and the conductors connected therewith. The magnets have a differential winding, and while the current passing from one rail to the other through the resistance coil is sufficient to energize the magnets 44a and attract their armature and close the circuit through the white light 59a, it is not sufficiently strong to energize the magnets 45a and attract their armature. One of these resistance coils is placed in each block, and it follows that as the magnets 44a will be energized continuously and the circuit be closed through them at all times, the white light 59a will burn all the time whether the train is in motion or not, and will indicate to the engineer that the system is in working order.

In this specification the white light is designated as the "good order" circuit and the red light as the "alarm circuit." Both of these circuits are connected with the main and auxiliary rails and with the pole-changer, but have independent sources of electrical energy. The resistance coil between the main and auxiliary rails will close the white light circuit and cause the lamp therein to burn continuously. The cur-

rent passing through the resistance coil will not close the red light circuit, which will remain open and the red lamp be dark until another locomotive enters the same block moving in the same or the opposite direction. The engineer will know by glancing at the white light whether the system is in working order or not as the train passes over the track from block to block, and whenever the red light flashes and the alarm bell rings he will know that another train is in the same block, and the engineer of that train will receive a similar warning. The closing of the red light circuit will cause the pole-changer to be locked automatically, and while the engineer is using the telegraph key and signaling the engineer of the other train, he can prevent the pole-changer from revolving by operating the key provided for that purpose.

Figures 13 and 14 show a switch equipped with the auxiliary rails and the short circuiting device.

This system of signaling, as described, is manufactured by the McClintock Manufacturing Company, of St. Paul, Minn.

Frenzied Jack Sense

The Duff Manufacturing Company, of Pittsburg, widely known in railway circles, because of the "Jack that Duff builds," has entered the field of history and poetry in a booklet recently issued under the title of "Frenzied Jack-Sense." We quote the following:

Archimedes, the most celebrated geometrician of antiquity, was born in Syracuse, Sicily, about 287 B. C. He discovered the principle of the lever and fulcrum, and his fame rests

"Give me where I may stand and I will move the world."
—Archimedes

largely on his remark, "Give me where I may stand and I will move the world." His theory was that he could move the world if he was given a lever of sufficient length and a place to stand in space. Archimedes was, therefore, the originator of the lifting jack, and was as famous in antiquity for jacks as is the Duff Manufacturing Company at the present day."

The following are historical verses, in boarding house metre, inspired by Archimedes and the Barrett jack:

"Give me where I may stand
and I will move the world."
—Archimedes.

Old A. Medes, no doubt
When he threw his chest out,
And gave vent to the sentiment quoted above,
Thought that he and his lever
Were pretty d——n clever
And nothing could stick if he wanted to shove.
No traveling circus or campaign oration
Ever awakened a town to a half the sensation
As in old Syracuse,
Where his words played the deuce
And started the tongues of the whole population.

And of all the glad rabble who babbled his praises,
There was only one soul who "renigged," as the phrase is;
This was Mrs. A. Medes, who sat in her snug house,
Possessed with the thought that her husband was bug house,
Or else (though she craftily kept the thing dark)
That he'd too much to drink when he made the remark.

She disliked his fads—she would simply not stand 'em,
Thus forgetting de gustibus non disputandum.
But old Mr. M., in the height of his pride,
At the way he was written up, talked of and eyed,
Having given his word
That the world could be stirred
If he'd only a place where to stand with his lever,
Swore he'd locate the spot if it took him forever.
And started right out
To meander about
Over mountain and plain,
Through the snow and the rain,
In the populous cities that dotted the highland,
And on the broad beaches that belted the island,
Which worried the life
Nearly out of his wife,
Because he'd go off without even a dollar—
No rubbers, no tooth brush, nor yet a clean collar—
And when he came in from a tramp through the furze,
His long, yellow whiskers were stuck full of burrs;
Not to mention the fact
That he showed lack of tact
By appearing most horribly late for his meals,
And we all know, when that happens, how the cook feels.

At length Mrs. M., tho' inclined to be lenient,
Decided his conduct was too inconvenient.
"This has all got to stop,
I will 'phone for a cop,
Or no, better yet, I'll destroy the idea
That has set Mr. Medes to acting so queer."

So when he came in she grabbed hold of his ear,
And having by this means enforced his attention,
Proceeded to "knock" his much-talked-of invention.

"Suppose," said the wife,
"After spending your life
In tramping the land
For a place where to stand,
You found it. What then?" "Why, I'd jam in my stick,"
Replied Mr. Medes, "and right away quick
You would feel the old earth change its berth in the sky;
And if that's not a stunt, well, I'd like to know why."

"Has it ever occurred,"
Mrs. M. gently purred,
"Has it ever occurred, Mr. Medes, to you,
When you once got the earth up there, what you would do?
To hoist it is easy, you dotty old jay,
But when you have got it there, how make it stay?"
A look of dismay
Was observed straightaway
O'er the features of poor Mr. Medes to play,
For he saw beyond doubt
That he'd gone and left out,
In his haste to be hailed as a dynamic king,
The sine qua non of the whole blooming thing.
All his work was in vain, his invention no use,
And his hopes were all flown
Of some day being known
As the Duff Company's equal in old Syracuse.

And so, with his nerves down and out with the shock,
He seated himself on a neighboring rock;
Thus sunk in dejection
He sat in reflection
Till nearly a year had dragged sluggishly by,
When he suddenly sprang to his feet with a cry:
"By Golly! I've got it," said he, "after all!
I'll lift the old globe like a medicine ball,
And when I am through

You'll see something new,
For once she is hoisted she'll stay hoisted, too.
If I use my old lever, of course she'll fall back,
So the thing I shall use is a small
BARRETT JACK.
Quick! Telegraph blanks! Send the Duff crowd a wire;
I'll show these Sicilians that I'm not a liar."

"Ah! but wait; don't forget,"
Said his wife, "that as yet
You will still retain one little problem on hand—
That little detail about where you will stand."

When the conquering Romans began their abuse,
And foreclosed the mortgage on old Syracuse,
Old A. Medes was found
Lying flat on the ground,
His bushy white whiskers all covered with sand.
A BARRETT TRACK AND CAR JACK in his hand,
Inspecting the heavens for some place to stand.

Notes of the Month

An experienced man is wanted by a prominent railroad in the United States as division engineer. Must be an experienced maintenance of way man. State experience, age and salary expected at the start. Address Railway Engineering and Maintenance of Way.

The Rodgers Ballast Car Co., Railway Exchange, Chicago, have just issued their 1906 booklet illustrating and describing the various types of cars which they manufacture. This briefly describes the cars together with all the advantages of the different combinations in which the Rodgers Ballast Hart Convertible cars can be used. Copies will be gladly furnished upon request.

The Duff Manufacturing Company, Pittsburg, Pa., was awarded the gold medal, highest award, on the Barrett Track and Car Jacks at the Lewis & Clark Exposition, Portland, Oregon. The Barrett Jacks were also awarded the gold medal at the Louisiana Purchase Exposition, St. Louis, 1904. The Duff Manufacturing Company manufacture the largest and most complete line of lifting jacks offered anywhere in the world and their product has been adopted as a standard for track and car work by practically every prominent railroad in the United States as well as in many of the foreign countries. These two gold medals are eloquent indications of the worth of the Barrett Jacks.

The iron bridge over the River Severn in England, erected about 1780, is yet in a good serviceable condition. Bridges of wood or stone were the standard construction before that date, and it is curious to note that the latter type of construction after having been displaced by iron and steel, is in the ascendant again in many places in which steel would prove impracticable to span spaces where stone is a solution of the problem. The ancient stone bridge engineer had little thought that his methods would ever be improved on, but such has been the outcome due to the age of steel, as well as this age of concrete; the latter form of construction coming very near to first principles as exemplified by the ancient artificer in stone.

There are few of the more important seats of learning that have not embodied in their curricula some branch of railroading. The School of Commerce of New York University is one of the latest of these to recognize the need of such instruction in the science of railroading and have introduced three courses on railway traffic for the coming school year under the direction of W. H. Fough, Jr. By the terms of the circular issued concerning this new move, "These courses are the beginning of an attempt on the part of the School of Commerce to put the study of railroad methods on a scientific basis, and to prepare young men for responsible positions in the railroad service more thoroughly and more quickly than can now be done. During the year classes in such subjects as railroad organization, railroad law and railroad accounts will probably be arranged. Eventually the school expects to offer railroad men a well rounded series of courses in their profession."

The Kobe (Japan) Chronicle of recent date says that it looks as if there will be a boom in electric railways before many months are past. The government railway passenger traffic between Kobe and Osaka has been so affected by the Hanjin Electric railway that the imperial railway working bureau is considering the advisability of establishing an electric line between the two cities and so meeting the competition. The bureau is also considering the establishment of such a railway between Tokyo and Yokohama, and so forstalling enterprise. This competition may be bad for the railways which suffer by it, but it is all to the benefit of the traveling public. The extent of this benefit may be judged when it is considered that the business man living in Kobe, who has to make frequent visits to Osaka, by using the electric railway not only saves enormously in the amount of fare, but travels nearly as quickly. He uses the electric route at this season of the year from choice, because of its freedom from soot and smoke.

A visit to Staten Island shows great activity on the part of the Baltimore & Ohio R. R. in the extensive improvement work planned for the betterment of its New York terminal. The new work comprises freight and passenger stations and coal and ashes installation all on the most modern lines at St. George, the northern terminus of the Staten Island Rapid Transit Co., which is an important auxiliary of the B. & O. On the section of the line between Clifton Junction and Arthur Kill bridge, 85-pound rails have been laid, and rock ballast is being applied. From South Beach to Arlington an automatic block signal has been put in. The whole roadbed is in a process of rejuvenation, while some 5,000 carloads of earth and rock is being used to fill in trestles at Livingston and Port Richmond. Besides the fill at this point, the B. & O. has used over 3,000 carloads at the long trestle at Linden Junction, N. J. The improvements of dock facilities is also receiving attention; extensions at Tompkinsville when completed will give a capacity of 400 cars of stone. At the latter place is also to be built a dock 476 x 51 feet, also a lighterage pier 485 x 30 feet and a double track foreign freight pier 800 x 100 feet.

Argentina has passed a law providing for the construction of a system of underground railroads in Buenos Aires. A copy of the bill was furnished by Minister Beaupre through the Department of State. Under the provisions of the bill the municipality will be authorized to concede the construction and exploitation of a system of underground electric railways for the service of the city and such other branches as may in succession be deemed advisable. The terms of the concession are as follows:

First. The contracting party shall construct the works at its own expense and in accordance with the plans approved by the executive.

Second. The contracting party shall also pay for all lands expropriated for tracks, stations, shops, etc.

Third. The contracting party shall administer and exploit the lines at their own expense and risk for a period of not more than forty years, at the end of which time they, with all their tracks, stations, shops, rolling stock, etc., shall become the property of the municipality.

As in the case of the projects reported all material intended for the construction and exploitation of these lines shall be admitted free of duty. It is reported that German capital is already interested in this matter, which is one of great importance and promise.

By an arrangement with the Chicago city council, the

Northwestern Elevated R. R. is conducting experiments with a view of finding a means of deadening the noise of trains on the elevated railways. The present experiments are confined to the Union loop structure on Wabash Ave., between Jackson Blvd. and Monroe street. Great simplicity of structure is used in these experiments. The ties have narrow strips nailed on each side near the bottom and short pieces of board nailed on to close the opening. The ends are closed in a similar manner, forming a box construction which is filled with fine gravel which will extend in depth to the head of the rail, so that the web and base of the rail are entirely bedded in gravel. It is expected that this simple method will result in the absorption by the gravel of the vibrations of the rail. It is expected to prove more effectual than bedding parts of the deck in concrete, on account of using a more elastic medium, and it is less expensive than any of the methods proposed previously. The disadvantages expected to arise from this are the dripping of moisture from the gravel and more especially in connection with snows. These considerations have prompted a modification which will also be tried. This consists in filling in only the space between the rail and the outside wooden guard rail, leaving the center of the track open as before. Even this is expected to show deicded results. About thirty days will elapse before the experiments will have reached a stage to warrant any positive conclusions or furnish any definite data.

Consul Mahin, of Nottingham, England, reports an automatic danger-signaling apparatus, to be used on railways. Theoretically, he says, the success of the new device is not doubted. Its practicability is questioned, however, because it may lead to carelessness on the part of those in charge of the trains. He writes:

A resident of Nottingham has invented a system of electric signaling on railways, of which the principle, at least, its friends believe, will be eventually adopted by the railways. By an ingenious plan, when danger or the necessity of proceeding cautiously is signaled a gong would sound on the engine and an immense "bull's eye," on the cab, glare with red or green light in the driver's face. Even the densest fog, that greatest peril to English railways, would thus be robbed of its danger, provided there was no failure in the apparatus or supply of the electric current. Beyond the spot where, at present, the distant signal is located on the railways the invention proposes that a central rail 100 yards in length should be laid, with a second and much longer central rail near the present home signal. Connected electrically with the signal box, the pressure of a roller beneath the engine on these central rails would not only ring a bell and cause a lamp (corresponding with the track upon which the train was running) to glow in the signal box, but bells would ring, and red or green lamps glow on the engine itself, the color of the lamp depending upon which rail (the right or left) the signalman had converted into a negative. The theoretical soundness of the invention is not questioned, but doubts of its practicability are expressed. Engineers, it is feared, would lose alertness and rely absolutely upon the gong; and should the apparatus fail to work, hideous results might follow. Besides, the expense of proper generating stations would presumably be enormous. But the idea of electric signaling is in favor in railway circles, and this invention is a step toward its effectuation.

Several years ago another Nottingham inventor devised a scheme for electric signaling, and constructed a model train and track to illustrate it. A copper-wire brush projected from each signal box. When the signal was placed at danger the brush caught upon a strip of copper extending the whole length of the model train, and caused a gong to ring on the engine and in the "brake van" at the end. The model worked perfectly. Railway experts watched it, but somehow doubted the reliability of the scheme. One railway took somewhat kindly to it, but only offered to place a branch line at the inventor's disposal for experiment, he to install the system at his own expense. This he was unable to do, and his invention rests in abeyance.

The dense fogs in winter and the attendant expense of employing extra men and means to avert disasters make the need of automatic signaling on English railways peculiarly imperative. Any practicable and relatively inexpensive system better than the methods now in use would be welcomed by them.

An excellent device for warning trains is the subject of the following report by Consular Clerk Murphy, of St. Catharines. If it does what it is said to do, the device is one that should be adopted in all parts of the world, particularly on such lines as are now only fairly well provided with danger signals. The report follows:

Much interest has recently been aroused in Germany by the success of all practical tests to which the Pfirmann-Wendorf apparatus for preventing railway accidents was subjected by the managers of the Frankfort on Main division of the Prussian State railways, experiments covering a period of several months, which proved uniformly satisfactory even under the most unfavorable conditions due to rain, snow, fog and darkness.

These experiments were made on a specially prepared track, several miles in length, extending from Goldstein to Sachsenhausen. Each locomotive used was supplied with a small Pfirmann-Wendorf apparatus, which with its storage battery occupied a space only 20 centimeters in depth and breadth, respectively, and 30 centimeters in length. Communication between this apparatus and the two track rails was supplied by the metal parts of the locomotive through the axles and wheels, while an insulated contact device connected the apparatus with a carefully insulated auxiliary rail running midway between the track rails, the contact device being so arranged that it could easily be moved back and forth or sideways. Positive and negative impulses could thus be sent in different directions, frequent changes being made from one rail to another.

If there is an obstruction of any kind within a certain distance, an alarm is thus given, both visibly and audibly, by means of a red light and by the ringing of a bell. No matter how many locomotives there may be on the track, each gives its warnings. Engineers, signalmen, and station master can thereupon communicate together by telephone, the central auxiliary rail serving as the channel of communication. In each locomotive there is a telephone which is protected against the vibrations caused by the motion of the locomotive through being fastened on springs like a bicycle lamp. In like manner in cases of sudden danger track guards can transmit a warning to the engineers of approaching locomotives.

If for any reason a storage battery becomes exhausted it can be replenished with electricity produced by the locomotive; and even if this supply fails, the current from a semaphore or signal station can still transmit to the engineer explanations and instructions. If by mistake a semaphore falsely registers "free track," the endangered trains nevertheless supply each other with signals of warning. An alarm is also given automatically when a switch is falsely set or insecurely closed.

This system requires neither wires nor poles, their place being supplied by massive and more reliable iron.

The auxiliary line, consisting of ordinary T iron, may be limited to important or dangerous portions of the track where the view is obstructed or to the vicinity of sidings, curves, bridges, and tunnels. Old rails may be utilized for the central auxiliary line. Thus the cost of even an uninterrupted line can be made exceedingly small in comparison with the value of lives and merchandise thus protected.